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## Summary

*Feeding wet distillers grains plus solubles (WDGS) improves the fertilizer value and net value of feedlot manure for all feedlot sizes. The net fertilizer value of feedlot manure increased 375% to 550% since 2006. Valuing manure at 2008 fertilizer nutrient prices and feeding 20% or 40% WDGS instead of feeding a corn-based diet improved profitability by $7 to $17 per steer finished ($4 to $11 per ton of manure).*

## Introduction

Previous research evaluated the effects of dietary ingredients (specifically wet distillers grains plus solubles [WDGS]) on the fertilizer value of manure (*2006 Nebraska Beef Report*, pp. 98-102; *2008 Nebraska Beef Report*, pp. 59-61). These two studies reported that the fertilizer value of feedlot manure increases as the concentration of N and P increase in the diet.

The previous studies did not consider the impact of different fuel and fertilizer prices on manure value. Therefore, the objective of this study was to use the Feed Nutrient Management Planning Economics (FNMP$) model to evaluate the fertilizer value of feedlot manure at different fertilizer and fuel prices.

## Procedure

The FNMP$ model (Koelsch et al., 2007; available at *http://water.unl.edu/mnmresources/software* under Software for Manure Management) has been described by Bremer et al. (*2008 Nebraska Beef Report*, pp. 59-61). The model calculates manure management economics based on animal nutrient intake, manure nutrient availability, land requirement for spreading, operating costs and fertilizer value. The model was used to compare 2006 and 2008 manure management costs and manure net values of diets containing 0%, 20% and 40% of diet DM as WDGS. These diets were calculated to have 0.29%, 0.39% and 0.49% phosphorus (P), respectively, and 13.0%, 15.3% and 18.7% crude protein (CP), respectively. These diets were evaluated for 2,500-, 10,000- and 30,000-head feedlots feeding two turns of cattle per year at full capacity.

*Key Assumptions*

Accounting for storage and field losses, 95% and 23% of excreted P and N, respectively, are available for crop growth. Average feedlot manure was calculated to be 74% ash and 70% DM with 57% reduction in manure organic matter (OM) content from excretion to pen cleaning (*2006 Nebraska Beef Report*, pp. 87-89 and 94-97). The cropping rotation is a corn on soybeans continuous rotation with 185 bu/acre corn and 50 bu/acre soybeans. Manure is applied at the 4-year P-based crop requirement, and 50% of the land around the feedlot is available for manure application. The manure application equipment

(Continued on next page)

**Table 1. Feedlot manure value ($/ton of manure at 70% DM) for three feedlot sizes feeding 0%, 20% or 40% WDGS with either 2006 prices of $0.19/lb N, $0.26/lb $P_2O_5$, and $1.50/gallon diesel or 2008 prices of $0.55/lb N, $0.98/lb $P_2O_5$, and $4.50/gallon diesel.**

| Year | 2006 | | | 2008 | | |
|---|---|---|---|---|---|---|
| Feedlot Size | 2.500 | 10,000 | 30,000 | 2,500 | 10,000 | 30,000 |
| **Manure Value** | | | | | | |
| 0% WDGS | ----------4.14---------- | | | ----------14.23---------- | | |
| 20% WDGS | ----------5.62---------- | | | ----------19.53---------- | | |
| 40% WDGS | ----------7.26---------- | | | ----------25.27---------- | | |
| **Spreading Cost** | | | | | | |
| 0% WDGS | 2.08 | 1.67 | 2.45 | 2.19 | 1.85 | 3.28 |
| 20% WDGS | 2.27 | 2.17 | 3.17 | 2.41 | 2.39 | 4.22 |
| 40% WDGS | 2.49 | 2.70 | 3.92 | 2.66 | 2.97 | 5.16 |
| **Net Value** | | | | | | |
| 0% WDGS | 2.06 | 2.47 | 1.69 | 12.04 | 12.38 | 10.95 |
| 20% WDGS | 3.36 | 3.45 | 2.45 | 17.12 | 17.13 | 15.31 |
| 40% WDGS | 4.76 | 4.56 | 3.34 | 22.61 | 22.30 | 20.11 |

**Table 2. Feedlot manure value ($/head finished) for three feedlot sizes feeding 0, 20, or 40% WDGS with either 2006 prices of $0.19/lb N, $0.26/lb $P_2O_5$, and $1.50/gallon diesel or 2008 prices of $0.55/lb N, $0.98/lb $P_2O_5$, and $4.50/gallon diesel.**

| Year | 2006 | | | 2008 | | |
|---|---|---|---|---|---|---|
| Feedlot Size | 2.500 | 10,000 | 30,000 | 2,500 | 10,000 | 30,000 |
| Manure Value | | | | | | |
| 0% WDGS | ---------- 6.72 ---------- | | | ---------- 23.09 ---------- | | |
| 20% WDGS | ---------- 9.12 ---------- | | | ---------- 31.68 ---------- | | |
| 40% WDGS | ---------- 11.78 ---------- | | | ---------- 41.01 ---------- | | |
| Spreading Cost | | | | | | |
| 0% WDGS | 3.37 | 2.72 | 3.97 | 3.55 | 3.00 | 5.32 |
| 20% WDGS | 3.68 | 3.52 | 5.12 | 3.90 | 3.88 | 6.84 |
| 40% WDGS | 4.04 | 4.38 | 6.36 | 4.32 | 4.82 | 8.37 |
| Net Value | | | | | | |
| 0% WDGS | 3.35 | 4.00 | 2.75 | 19.54 | 20.09 | 17.77 |
| 20% WDGS | 5.44 | 5.60 | 3.97 | 27.78 | 27.80 | 24.84 |
| 40% WDGS | 7.73 | 7.40 | 5.41 | 36.68 | 36.19 | 32.63 |

**Table 3. Average manure value (FOB the feedlot) based on 16.9 lb N and 18.2 lb $P_2O_5$ per ton of manure at 70% DM.**

| | $P_2O_5$, $/lb | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N, $/lb | 0.40 | 0.50 | 0.60 | 0.70 | 0.80 | 0.90 | 1.00 | 1.10 | 1.20 | 1.30 | 1.40 | 1.50 |
| 0.20 | 10.70 | 12.53 | 14.35 | 16.18 | 18.01 | 19.83 | 21.66 | 23.49 | 25.32 | 27.14 | 28.97 | 30.80 |
| 0.30 | 12.39 | 14.22 | 16.05 | 17.87 | 19.70 | 21.53 | 23.36 | 25.18 | 27.01 | 28.84 | 30.67 | 32.49 |
| 0.40 | 14.09 | 15.91 | 17.74 | 19.57 | 21.40 | 23.22 | 25.05 | 26.88 | 28.71 | 30.53 | 32.36 | 34.19 |
| 0.50 | 15.78 | 17.61 | 19.43 | 21.26 | 23.09 | 24.92 | 26.74 | 28.57 | 30.40 | 32.23 | 34.05 | 35.88 |
| 0.60 | 17.47 | 19.30 | 21.13 | 22.96 | 24.78 | 26.61 | 28.44 | 30.27 | 32.09 | 33.92 | 35.75 | 37.58 |
| 0.70 | 19.17 | 21.00 | 22.82 | 24.65 | 26.48 | 28.30 | 30.13 | 31.96 | 33.79 | 35.61 | 37.44 | 39.27 |
| 0.80 | 20.86 | 22.69 | 24.52 | 26.34 | 28.17 | 30.00 | 31.83 | 33.65 | 35.48 | 37.31 | 39.14 | 40.96 |
| 0.90 | 22.56 | 24.38 | 26.21 | 28.04 | 29.87 | 31.69 | 33.52 | 35.35 | 37.18 | 39.00 | 40.83 | 42.66 |
| 1.00 | 24.25 | 26.08 | 27.90 | 29.73 | 31.56 | 33.39 | 35.21 | 37.04 | 38.87 | 40.70 | 42.52 | 44.35 |

was chosen to be the most economical and time-effective for each operation size. The optimum manure application equipment for the 2,500- 10,000- and 30,000-head capacity yards included: one 16-ton truck-mounted spreader, one 28-ton truck-mounted spreader, and three 28-ton truck-mounted spreaders, respectively. The labor rate was set at $12/hour. The 2006 fertilizer prices used were $0.19 and $0.26 per lb of N and $P_2O_5$, respectively. The 2006 fuel price used was $1.50 per gallon diesel fuel. The corresponding 2008 N, $P_2O_5$ and fuel prices are $0.55, $0.98 and $4.50, respectively. Manure's N and P values are included in the analysis, while no value was assigned to organic matter, potassium, other micro-nutrients and water-holding capacity.

*Manure Value Table*

A table of manure fertilizer values (FOB the feedlot) at different N and $P_2O_5$ prices was constructed using average feedlot manure N and P composition based on data collected from six Nebraska feedlots over a one-year period (*2006 Nebraska Beef Report*, pp. 94-97). The N and P values for the manure were 1.21% and 0.57% of DM, respectively. On a DM basis, these values translate into 24.2 and 26.1 lb of N and $P_2O_5$ per dry ton of manure (16.9 and 18.3 lb of N and $P_2O_5$ per wet ton at 70% DM).

## Results

The values of manure from 2006 and 2008 were expressed per ton of manure (70% DM; Table 1). The manure values were calculated on a "per animal finished" basis (Table 2) to show the effects of proper nutrient management on individual animal profitability. Changes in manure DM and ash (soil contamination) content influenced the manure's nutrient concentration and value. Therefore, collecting accurate manure composition data is an important part of manure management plans and assessing manure value.

Feeding 20% or 40% WDGS increased manure value without management costs by 36% and 76%, respectively, compared to manure from cattle fed a corn-based diet. Manure management costs of a 2,500-head feedlot increased by 10% and 20% when feeding 20% and 40% WDGS, respectively, due to higher hauling costs for longer average haul distances when manure contains greater nutrient concentrations. The costs for larger feedlots (10,000- and 30,000-head) feeding 20% or 40% WDGS increased by 30% and 60%, when feeding 20% or 40% WDGS, respectively. However, the increased costs were more than offset by the increased manure value if 1) manure is applied at a 4-year P-based rate, and 2) manure is valued for its ability to replace N and P fertilizers. Feeding 20% to 40% WDGS resulted in a 40% to 130% increase in manure net value relative to manure from cattle fed corn.

The increase in fertilizer and fuel prices of 2008 compared to 2006 changed the value of manure with minimal impact on spreading costs, which changed manure net value. Manure value increased by 246% from 2006 to 2008. Costs increased by 5% to 34% from 2006 to 2008. This resulted in a 375% to 550% increase in manure net value.

Valuing manure at 2006 fertilizer nutrient prices and feeding 20% or 40% WDGS instead of feeding a corn-based diet improved individual animal profitability by $1.22 to $4.38 per finished steer, respectively, not accounting for improved animal feeding performance from WDGS. Valuing manure at 2008 fertilizer nutrient prices and feeding 20% or 40% WDGS instead of feeding a corn-based diet improved individual animal profitability by $7.07 to $17.14 per finished steer ($4.36 to $10.57 per ton of 70% DM manure).

In conclusion, fertilizer value of manure has dramatically increased in recent times. Feedlot managers who feed WDGS (and other byproducts) may be able to improve operation profitability by increasing manure revenue.

Table 3 provides methods to value manure based on current fertilizer prices. This table assumes average feedlot manure characteristics of 16.9 lb N and 18.2 lb $P_2O_5$ per ton of manure at 70% DM. Conducting manure nutrient analysis is an important part of accurate manure valuation and a requirement for nutrient management plans. Moisture and ash content of the manure may impact manure value. Therefore, these table values are not accurate for all situations.

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